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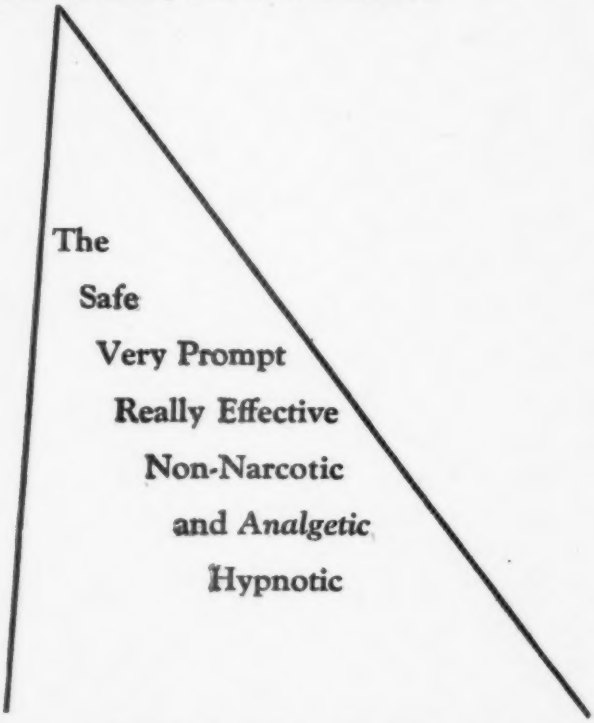

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CYCLIC CHANGES IN THE SPONTANEOUS CONTRACTIONS OF THE HUMAN FALLOPIAN TUBE[1]

D. L. SECKINGER AND F. F. SNYDER

From the Carnegie Institution of Washington, Department of Embryology, Johns Hopkins Medical School, Baltimore

INTRODUCTION

In recent investigations of the spontaneous contractions of the Fallopian tube *in vitro*, it has been shown that the time of ovulation in the pig (Seckinger, 1923) and in Macacus rhesus (Seckinger and Corner, 1923) is characterized by a definite type of tubal contractions, which are easily distinguished from those found at other times during the reproductive cycle and pregnancy. Since a very similar alteration occurs in species so widely separated as the pig and monkey, it might perhaps be anticipated that in the human, likewise, there would be a corresponding change in the contractions of the tube coincident with ovulation.

We have undertaken to observe, therefore, the living muscle of the human tube, in an attempt to recognize at what stage of the menstrual cycle this organ is in function. Thus, by recording the contraction of the tube at all phases of the cycle and during pregnancy, any period of increased peristaltic activity might be revealed.

METHOD AND MATERIAL

In a preliminary report (Seckinger and Snyder, 1924) it was pointed out that the human tube undergoes contractions spontaneously, when suspended in a bath of warm, oxygenated Locke solution. The usual procedure is to take a ring of the tube wall about 5 mm. wide from near the middle portion of the tube, and attach it to one arm of a lever writing on the kymograph. In making up the Locke solution the distilled water was collected from a glass condenser, and used as fresh as possible. Oxygen was bubbled through the bath at a uniform rate, and the temperature was kept about 37.5°C.

[1] Received for publication July 14, 1926.

Further control of the Locke solution was possible in some cases when more than one specimen was obtained during the same morning and portions of the same lot of Locke solution could be used for the different tubes. Thus the contractions obtained from the interval tube No. 22 are strikingly different from those seen in the tracing of tube No. 23, which was from a pregnancy, though the latter was run within a half hour after No. 22, the same lot of Locke solution being employed.

The material for the present study was obtained from the Woman's Clinic of the Johns Hopkins Hospital, through the courtesy of Professors T. S. Cullen and J. Whitridge Williams. The tubes were taken from the operating room, and records of the contractions were made at once, although occasionally the tubes were kept several hours in a glass dish in the ice box.

In the selection of the material, obviously abnormal tubes were excluded. The specimens from pregnancy were obtained chiefly from cases in which a small portion of the tube was removed at the time of a repeated Caesarean section or when systemic disease necessitated surgical intervention. The specimens from the non-pregnant were obtained chiefly from cases of myoma uteri. A full history of the case was obtained.

The present observations are based upon a total of 27 specimens which were obtained during pregnancy and various stages of the menstrual cycle, according to evidence based upon anatomical findings in each case. No specimen was used for determining the phase of the cycle unless it had at least a small portion of the surface epithelium of the endometrium intact. Measurements of the tubal epithelium were taken on sections from the isthmus or ampulla.

OBSERVATIONS

In observing the activity of isolated rings of the Fallopian tube, it becomes evident that the tubal muscle tends to maintain contractions with a rhythm which remains characteristic in a given specimen as seen in the kymograph tracings (Plate 1). Usually within an hour after setting up the experiment the rate and amplitude of the tubal contractions form a distinctive pattern.

From a glance at Plate 1, which includes records obtained during the

reproductive cycle and pregnancy, it is apparent that the activity of one tube may be strikingly different from another. At one extreme (Fig. 1) the tubal contractions average about 4 per minute and are of equal amplitude, while in another tube (Fig. 5) the contractions are twice as rapid and show a striking alternation in amplitude. Transitional stages are found between these extremes.

Correlation of the striking changes in activity of the muscular wall of the tube with the structural alterations in the ovaries, tube and uterus during the menstrual cycle and pregnancy is especially interesting.

In ten specimens which were obtained during pregnancy (Table I) the contractions of the tube are slow (about 4 per minute) and of equal amplitude (Fig. 1).

During the menstrual cycle similar slow tubal contractions are found to occur in tubes (Table II) from the 3 specimens in which the endometrium on histological examination shows secretory changes characteristic of the pre-menstrual and menstrual phase of the cycle as described by Hitschmann and Adler (Fig. 2, Fig. 3). On the other hand, in the 3 specimens in which the endometrium shows the changes which mark the late interval phase (Table II), the tubal muscle is definitely more active (Fig. 4). There is an increase in the rate of the contractions and a marked variation in amplitude.

A transitional condition is found in the 3 specimens with endometrium in the early interval phase (Table II). The contractions of the tube are more rapid than has been found during pregnancy or the pre-menstrual phase, but they are of uniform amplitude.

The changes in the tubal contractions, therefore, seem to parallel closely the structural alterations in the uterine mucosa during the reproductive cycle.

The ovary has been available for histological examination in two specimens obtained during the menstrual cycle, in which the tubal contractions are sharply different in pattern. In one specimen, No. 39, the contractions average 3 per minute and are of uniform amplitude. There is a well differentiated corpus luteum in the ovary, measuring at least 11 mm. in diameter, which on microscopical examination shows no signs of retrogression. In the endometrium, changes of the premenstrual type are evident.

TABLE I

Specimens obtained during pregnancy

NUMBER	TUBAL CONTRACTIONS		TUBAL EPITHELIUM AVERAGE HEIGHT	UTERUS	REMARKS
	Amplitude	Average rate per minute			
			micra		
2	Uniform	—	15	Pregnant	
14	Uniform	4	—	Pregnant	
16	Uniform	4	15	Pregnant	50 mm. embryo, age 11 weeks (estimated)
23	Uniform	4	—	Pregnant	
24	Uniform	4	—	Pregnant	
30	Uniform	4	—	Pregnant	
34	Uniform	3	—	Pregnant	4 months—see Obst. Hist. 13250
37	Uniform	4	15	Pregnant	
44	Uniform	4	—	Pregnant	
50	Uniform	3	—	Pregnant	

TABLE II

Non-pregnant specimens datable by endometrium and tubal mucosa

NUMBER	TUBAL CONTRACTIONS		TUBAL EPITHELIUM AVERAGE HEIGHT	UTERUS	REMARKS
	Amplitude	Average rate per minute			
			micra		
8	Uniform	3	—	Pre-menstrual	
33	Uniform	4	20	Menstrual	Probably near end of menstruation
39	Uniform	3	—	Pre-menstrual	Corpus luteum 11 mm. in diameter
46	Uniform	5	25	Interval, early	
55	Uniform	5	27	Interval, early	
29	Uniform	5	24	Interval, early	
27	Not uniform	7	22	Interval, late	
28	Not uniform	5	24	Interval, late	
40	Not uniform	6	24	Interval, late	

In the second specimen, No. 22, the activity of the tubal muscle is in striking contrast (Fig. 5). There are 8 contractions per minute,

with a marked alternation in amplitude. The ovary of this specimen is of great interest. It shows, on section (Fig. 7), a recently collapsed follicle which is lined with a granulosa layer that is already invaded by sprouting capillaries. The theca interna appears well developed and there is considerable hemorrhagic extravasation, such as Reusch (1916) had previously described in early corpora lutea. When observed at the time of removal, the ovary showed an area containing a dark red blood-clot. Although the endometrium was not available for study, the tubal mucosa of this specimen was at hand, and on examination was found to show the striking structural alteration which is met with at the mid-interval phase of the cycle (Snyder, 1924). The epithelium measured 35 microns in height and had a smooth surface, so that it was in definite contrast to the low (20 microns) tubal epithelium with marked projections of the non-ciliated cells, which is seen when the uterine mucosa shows the pre-menstrual changes, or during pregnancy.

Thus the tubal muscle shows a greatly increased activity in the specimen obtained about the mid-interval phase, in which there was probably a recently discharged ovum, in contrast to the specimen obtained during the premenstrual phase, in which there was a large, well differentiated corpus luteum. Likewise, in the ten specimens from pregnancy which are known to have large corpora lutea, the tubal contractions were slow.

In the specimens listed in Table III, anatomical evidence of the stage of the cycle, at which the tubal contractions were obtained, depends upon examination of the epithelial lining of the tube, since the uterine mucosa was not available. On microscopical examination, the tubes (Table III) show various stages of the structural changes of the epithelium which are characteristic of the interval phase of the cycle, and are in marked contrast to the alterations seen during the pre-menstrual phase and during pregnancy, according to the criteria outlined in a previous investigation of the cyclic changes in the tube (1924). The tubal muscle also shows greater activity, in the specimens given in Table III, than is to be found in any of the tubes obtained during pregnancy (Table I) or in the pre-menstrual phase of the cycle (Table II). It would appear, therefore, that the tubes of Table III are all from the interval phase.

In a few cases, tubes were obtained from patients who were more than 50 years of age. Contractions always occur, but the material is not sufficient to determine the pattern of the contractions, though it suggests that they may be different from those seen during the reproductive cycle.

In the course of collecting the present material we had an opportunity to examine the tubal epithelium while the cilia were still beating actively. No variation in the number or activity of the cilia of the tubal mucosa was noted in this series at any phase of the cycle, or during pregnancy.

TABLE III

Non-pregnant specimens datable by tubal mucosa only

NUMBER	TUBAL CONTRACTIONS		TUBAL EPITHELIUM AVERAGE HEIGHT	REMARKS
	Amplitude	Average rate per minute		
			micra	
19	Not uniform	6	24	
20	Not uniform	7	21	
22	Not uniform	8	35	Ovary with recently ruptured follicle
35	Not uniform	8	27	
47	Uniform	5	27	
48	Uniform	5	27	
49	Uniform	5	27	
54	Not uniform	5	24	

DISCUSSION

From the foregoing observations it appears that there are cyclic changes in the activity of the excised muscular wall of the tube, which parallel chronologically the structural changes in the tubal and uterine mucosa. The tubal contractions are slow (about 4 per minute) and of uniform amplitude during the pre-menstrual phase; more rapid contractions are found early in the interval phase; while about mid-interval the contractions are markedly increased in rate (about 8 per minute) and show a striking variation in amplitude. During the late interval, also, the contractions show an increase in rate and recurrent changes in amplitude.

In the two specimens in which an ovary is available it is evident that the recently ruptured follicle in the one case and the large, well differentiated corpus luteum in the other represent directly opposite phases of the cycle, namely, ovulation and implantation. It is interesting to find that the tubal contractions are similarly in striking contrast, showing great activity in the case of the recently ruptured follicle. In the 10 specimens from pregnancy, when the corpora lutea are known to be well differentiated, the contractions remain slow and of uniform amplitude as in the pre-menstrual phase of the cycle.

It is apparent that the above results fall into line with the more adequately controlled observations of Seckinger on the pig and of Corner and Seckinger on the monkey. Those animals from which tubal ova have been recovered, always exhibit contractions which are rapid and of varying amplitude in contrast to the slow contractions of uniform amplitude seen during the implantation phase when the ova are in the uterus.

The physiological significance of this periodic increase in activity of the tubal wall is difficult to evaluate in the absence of direct observations on the transport of the ovum under definitely contrasting conditions.

SUMMARY

1. There are spontaneous contractions of the excised human Fallopian tube which show periodic changes in rate and amplitude during the menstrual cycle.

2. The cyclic changes in the activity of the muscular wall of the tube closely parallel chronologically the histological changes occurring in the endometrium and tubal mucosa during the reproductive cycle as follows:

(a) During the mid- and late-interval stage, there are rapid contractions showing a marked variation in amplitude.

(b) During the pre-menstrual and menstrual phase, slow contractions of uniform amplitude are found.

3. Pregnancy inhibits the changes in tubal contractions, which remain slow and of uniform amplitude.

4. Comparison with other mammals suggests that in the human the increased activity of the tubal wall during the mid- and late-interval

stage is probably coincident with the passing of the ovum through the tube.

5. No change in the number or activity of the cilia lining the tube was noted at any phase of the reproductive cycle of pregnancy.

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PLATE 1

KYMOGRAPH TRACINGS OF SPONTANEOUS CONTRACTIONS OF HUMAN FALLOPIAN TUBES IN VITRO

Each interval on the base-line indicates one minute.

FIG. 1. No. 24, pregnancy at term.
FIG. 2. No. 33, menstrual.
FIG. 3. No. 8, pre-menstrual.
FIG. 4. No. 27, late interval.
FIG. 5. No. 22, mid-interval.
FIG. 6. No. 55, early interval.

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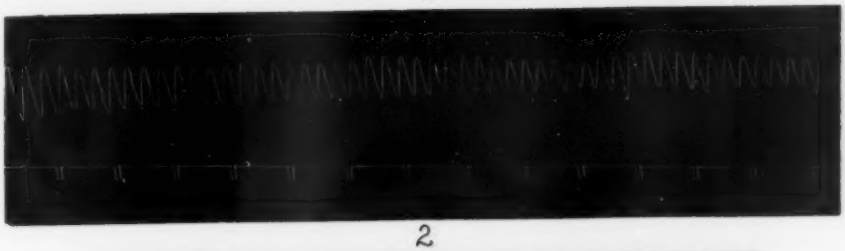

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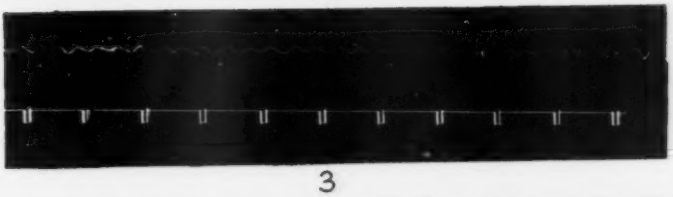

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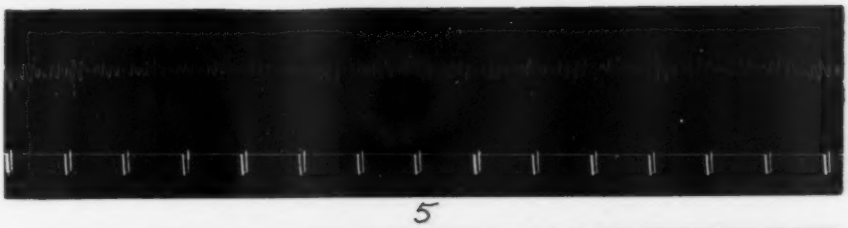

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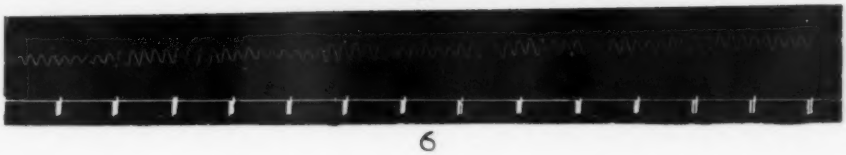

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PLATE 2

PHOTOMICROGRAPHS

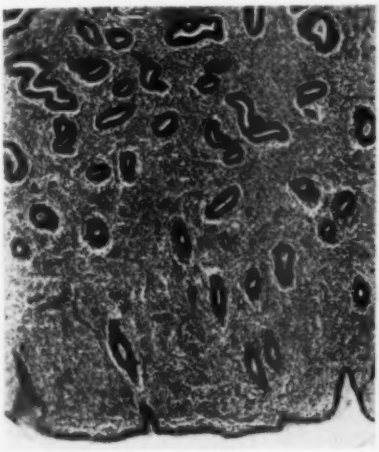
FIG. 7. Wall of recently ruptured Graafian follicle of No. 22 (cp. Plate 1, Fig. 5). × 400.

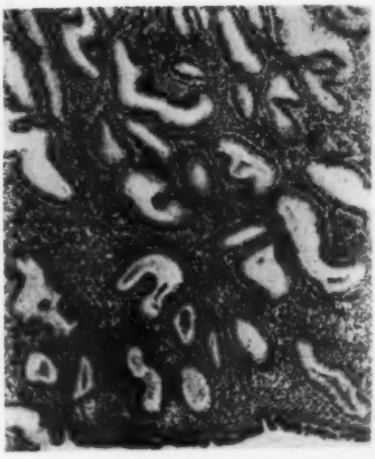
FIG. 8. Endometrium of No. 33, menstrual (cp. Plate 1, Fig. 2). × 40.

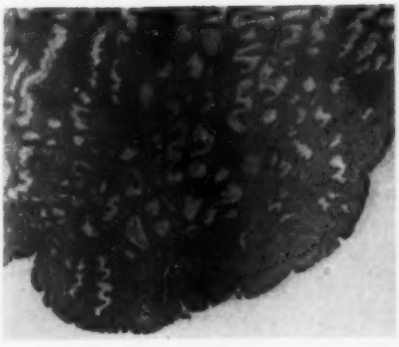
FIG. 9. Endometrium of No. 8, pre-menstrual (cp. Plate 1, Fig. 3). × 21.

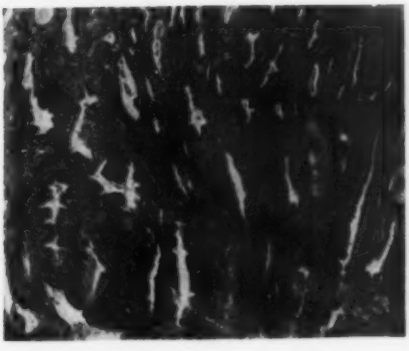
FIG. 10. Endometrium of No. 27, late interval (cp. Plate 1, Fig. 4). × 60.

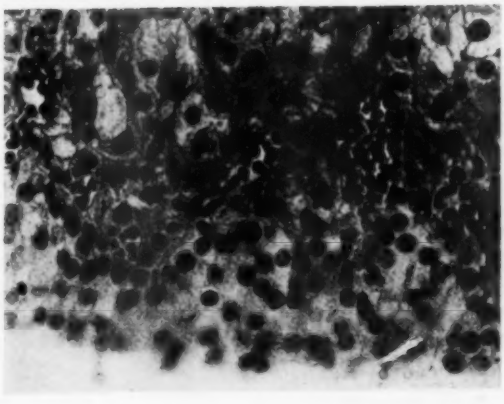
FIG. 11. Endometrium of No. 55, early interval (cp. Plate 1, Fig. 6). × 43.











A QUANTITATIVE STUDY OF THE EFFECT OF SODIUM BICARBONATE ON GASTRIC FUNCTION[1]

CHESTER S. KEEFER AND ARTHUR L. BLOOMFIELD

From the Biological Division of the Medical Clinic, Johns Hopkins Hospital and University

INTRODUCTION

The effect of sodium bicarbonate on gastric activity has been a matter of interest to physicians for many years, especially in connection with the therapy of gastric ulcer. Curiously enough, simple though the matter seems, there still is considerable disagreement as to just what soda does. Some have suggested that, aside from its obvious neutralizing effect, it causes an actual depression of gastric secretion, whereas others have claimed that soda is followed by an excessive production of acid. Various alterations in motility have also been described. A possible explanation of some of the discordant views may lie in the size of the dose, for it is evident that very large amounts of soda, in addition to neutralizing acid, produce the violent irritative effects displayed by any salt introduced into the gastrointestinal tract in high concentration.

A method, previously described by us (1)[2] for the simultaneous quantitative estimation of the volume of gastric secretion, of the acidity of gastric juice and of the motility of the stomach seemed specially suitable for studying the effects of sodium bicarbonate, and was therefore employed in the present study.

LITERATURE

Carlson (2) has recently reviewed this subject and has given a complete bibliography. To summarize the prevailing views rather

[1] Submitted for publication August 1, 1926.

[2] We should like to call attention to a typographical error in our paper on "A Method for the Continuous Quantitative Estimation of Gastric Secretion and Discharge in Man." *Arch. Int. Med.*, **37**, 819, (June) 1926. On page 822, under (6), the formula (1) should be $\left(\frac{x}{y} \times a\right) - a$ instead of $\left(\frac{y}{x} \times a\right) - a$, and the word *excreted* in line 18 should be *secreted*.

briefly, it may be stated that the experimental observations on animals, as well as on man, have yielded quite discordant results. From animal experiments some investigators contend that gastric secretion is stimulated by the administration of sodium bicarbonate, while others maintain that it is depressed. Still others claim that sodium bicarbonate stimulates gastric secretion until doses have been given that are large enough to cause irritation, and that depression then ensues (3). Most of the experimental observations have been made on animals with Pavlov or Heidenhain pouches. The experiments on man have been done by withdrawing gastric contents at different intervals of time after the administration of sodium bicarbonate or by

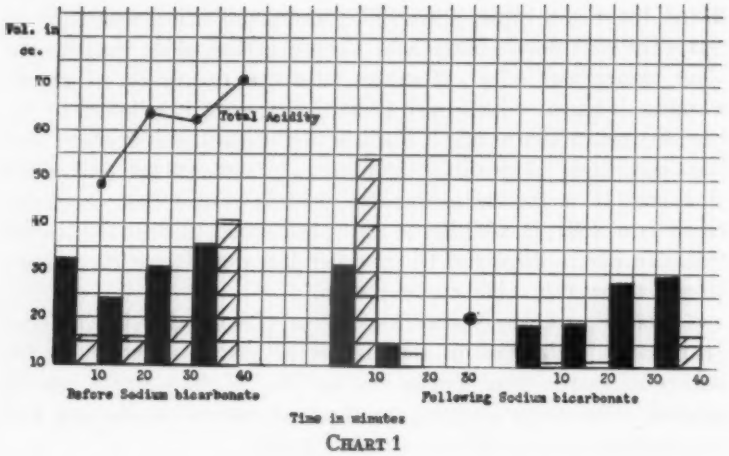


CHART 1

using the fractional method, but here, again, diverse results have been obtained. Crohn (4), using the fractional method, concluded that sodium bicarbonate neutralized acid for the moment, but that this temporary neutralization was followed by an irritative action in the course of which the acid returned quickly to at least the level of the control test at the corresponding time. In some of his observations, he felt that gastric secretion was first suppressed and later stimulated so that a "secondary hyperacidity" was produced. So far, then, it is clear that with the methods heretofore employed, the results have proved conflicting.

METHODS

The volume of gastric secretion, and the degree of acidity and motility following a standard stimulus before and after the administration of sodium bicarbonate were studied. The control test was carried out by the method which we have previously described and, subsequently, the identical procedure was repeated, except that soda (usually 1 gram[3]) was added to the alcohol test meal before it was taken into the stomach. None of the subjects had any digestive disorder.

In Chart 1 and Table I are shown the complete protocols of an examination in order to illustrate the method as carried out in each case. The general results will, however, be presented by composite diagrams.

Chart 1 shows the amount of juice secreted and discharged during ten-minute periods before and after the alkali. It also demonstrates the concentration of the acid of the pure juice before alkali, and the time at which the stomach contents become acid after alkali. The total amount of stomach contents at each ten-minute period is also charted.

RESULTS

The effect of soda bicarbonate on the volume of gastric secretion

In a previous study (5) it was found that "healthy" people usually secreted from 10 to 40 cc. of gastric juice for a ten-minute period following the standard alcohol test stimulus. In Chart 2 are recorded the secretory volumes of six persons before and after the administration of 1 gm. of soda. Each vertical series of dots refers to the examinations of one person.

As it happens, the volumes after soda were slightly smaller than before; however, the difference cannot be regarded as definite when the limits of error of the method are considered, and when the curves are studied as a whole, it would seem that the volume of secretion has not been influenced.

[3] This dose was selected because it is too small to have any material irritative action; on the other hand, it is capable of neutralizing approximately 75 cc. of N/10 HCl.

TABLE I

SPECIMEN NUMBER	OBTAINED	AMOUNT AND APPEARANCE	pH	TITRATABLE ACIDITY		TOTAL STOMACH CONTENTS	SPECIMEN RETAINED	AMOUNT RETURNED TO STOMACH	PHTHALEIN READING	AMOUNT		TITRATABLE ACIDITY OF PURE JUICE
				Dimethyl	Phenolphthalein					Secreted in 10-minute period	Discharged in 10-minute period	
				Before sodium bicarbonate								
						cc.	*cc.*	*cc.*	*per cent*	*cc.*	*cc.*	
1	Fasting	30 cc. clear juice	–	0	–							
2	Fasting, 5 minutes after No. 1	16 cc. clear juice	–	0	–							
3	Fasting, 10 minutes after No. 1.	8 cc. clear juice	2.0	12	4.0							
4	Immediately following meal	Clear fluid with a little mucus	2.2	6	4.0	46	10	36	81			53
5	10 minutes after meal	Clear fluid with a little mucus	1.6	26	4.0	58	10	48	45	27	5	54
6	20 minutes after meal	Clear fluid with a little mucus	1.4	40	4.0	64	10	54	23	37	31.0	57
7	30 minutes after meal	Clear fluid with a little mucus	1.3	48	4.0	62	10	52	17	15.5	7.5	62
8	40 minutes after meal	Clear fluid with a little mucus	1.2	60	4.0	50	10	40	9	29.5	31.5	70
9	50 minutes after meal	Clear fluid with a little mucus	1.2	58	4.0	44	10	34	6	17.5	13.5	65
10	60 minutes after meal	Clear fluid with a little mucus	1.3	50	4.0	16	–	–	Trace			54

Following sodium bicarbonate—1 gram

1	Immediately after 1 gm. soda	Slightly turbid	8.0	0	–	44	10	34	80			
2	10 minutes after soda	Slightly turbid	8.0	0	–	54	10	44	40	30.5	10	
3	20 minutes after soda	Slightly turbid	6.8	0	–	44	10	34	30	12.0	13	
4	30 minutes after soda	Clear fluid	1.8	26	6	24	10	14	15	23.0	32	
5	40 minutes after soda	Clear fluid	1.3	50	6	34	–	–	Trace	–	–	

G. (No. 198) aet. 14 years.
Diagnosis—convalescent toxemia of pregnancy.
No symptoms of digestive disturbance.
Total fasting contents, 54 cc.
Largest amount secreted in 10 minutes before soda, 37 cc.
Largest amount secreted in 10 minutes after soda, 30.5 cc.
Stomach empty before soda, 60 minutes.
Stomach empty after soda 40 minutes.
Largest amount in stomach before soda 64 cc.
Largest amount in stomach after soda 54 cc.
Average amount secreted in 10 minutes before soda, 27 cc.
Average amount secreted in 10 minutes after soda, 21 cc.

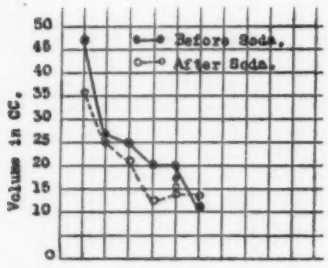


CHART 2

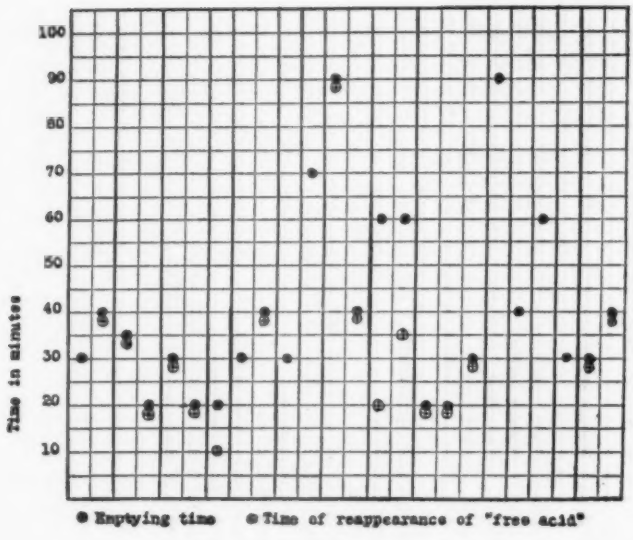


CHART 3

The reappearance of "free acid" following administration of sodium bicarbonate

One of the main objects of this study was to determine how much time elapsed after the administration of soda before free acid reap-

peared in the stomach. The interval evidently depends on two factors—motility and volume of secretion. If the stomach empties quickly, the soda is, of course, discharged, and even if the secretion is scanty and not very acid, the neutralizing effect of the alkali might be quickly overcome. Conversely, if the alkali remains in the stomach,

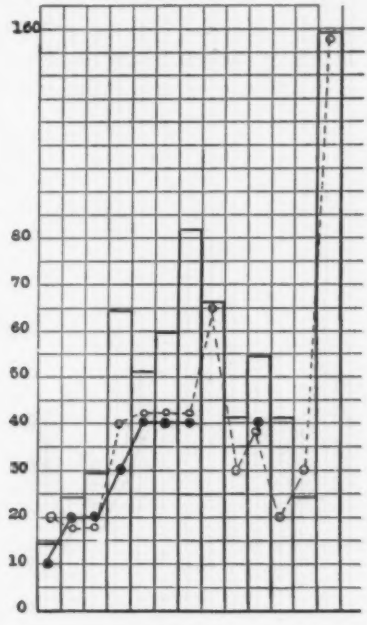


CHART 4

quite a large volume of secretion might be produced before free acid reappeared. These two factors were analyzed as follows:

(*a*) *The relation of emptying time to reappearance of acid.* The findings are shown graphically in Chart 3. Each group of dots in a vertical column refers to one test; two or more groups between the heavy lines indicate repeated examinations of the same person. One is immediately struck by the coincidence of emptying time and reappearance of free acid in most of the observations, and this indicates

that the dose of alkali (1 gm.) was usually adequate to neutralize all the acid secreted and that it was only after the alkali had been discharged from the stomach that free acid reappeared. Furthermore, this coincidence is seen even when there were marked variations in the emptying time in the same person on successive tests. In a word, one gram of soda has such a high neutralizing value that, unless a great deal of acid is secreted, the stomach will empty before an acid reaction is reëstablished. This point is emphasized in the chart by observations in which, even with very long emptying times, free acid failed to reappear (columns with black dots only).

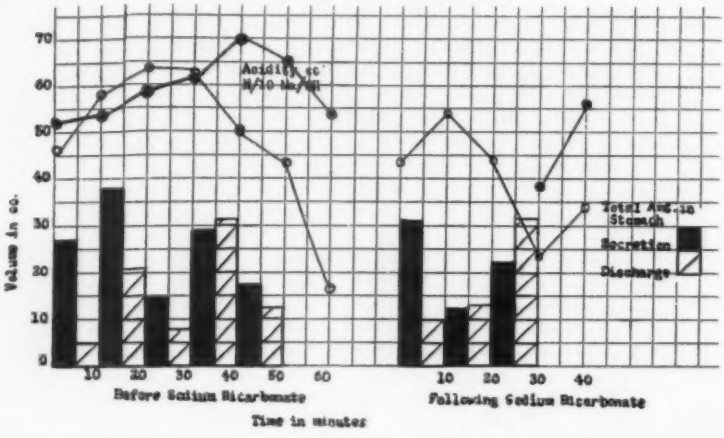


CHART 5

It is evident, then, that its motility influenced the reaction of the stomach after alkali in a significant manner.

(*b*) *Relation of volume of secretion to reappearance of free acid.* As pointed out above, the volume of acid secreted would, theoretically, have a very important influence on the reappearance of free acid, but with the doses of alkali employed, this factor is actually overshadowed by the effects of motility.

A study of Chart 4 shows that there was no relationship either between the volume of juice and the reappearance of free acid, or between the volume and the emptying time. On the other hand, the

relation between emptying time and reappearance of acid is obvious. To emphasize this point further, the findings in a case in which repeated examinations were made are charted (Chart 5). The motility was different on successive occasions and free acid had reappeared in the first test after 30 minutes, but not in the second test after 40 minutes, although, on the latter occasion, more juice was secreted.

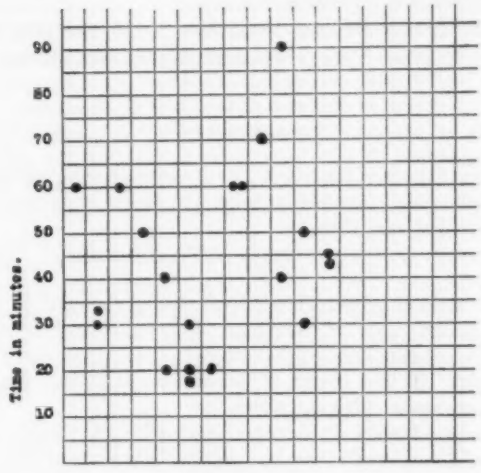


CHART 6

The effect of alkali upon motility (emptying time)

Motility of the stomach (emptying time) varies greatly in different people and in the same person on different occasions (5). In Chart 6 are shown the emptying times in the various tests made with alkali. The general range of variation is within the limits of normal and it is impossible to conclude that alkali in the doses employed has any effect on gastric motility.

SUMMARY

The following conclusions based on the use of small doses of sodium bicarbonate (1 to 2 gm.) may be drawn:

(*a*) The introduction of alkali into the stomach causes neither an increase nor a decrease in the volume of the gastric juice secreted.

(*b*) The time at which "free acid" reappears in the stomach contents after the administration of sodium bicarbonate depends largely on the emptying time of the stomach. The more rapid the motility, the sooner "free acid" will appear. Volume of secretion is of less importance.

(*c*) No definite changes in motility can be attributed to alkali on the basis of these experiments.

Finally, (*d*) it may be said that there is no evidence that alkali exercises effects other than a quantitative neutralization of gastric acid.

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BOOK REVIEWS

Oxford Bibliographical Society. Proceedings and Papers. Volume I, Part III. 1925. 246 pp. 2 plates. (Printed for the Society at the Oxford University Press, Oxford, 1926.)

This volume is devoted to Robert Burton and his Anatomy of Melancholy. To the Burtonian,—and there are doubtless a few of them existing even to-day—it is filled with intensely interesting matter. The Bibliography of the Oxford Editions of The Anatomy, Professor Bensly's able paper on the alterations and errors in successive editions, and the complete lists of Burton's books, that went by will to the Bodleian and to Christ Church Library, supply authoritative information that can be found nowhere else. But to Americans, especially to "Hopkinsian Baltimoreans" the chief interest of this volume lies in four papers by Sir William Osler. A brief paper (p. 216) on "Burton as a Transmitter;" and a long article (p. 163–182) on "Robert Burton, The Man, His Book, His Library." This article is not exactly a unity. Passages in one part of it are repeated in another. It is composed of three papers. The first two were written at one time and then, later, fused into one for a Yale lecture, printed in 1914. The third paper was read in London, in 1909. The chapter on Burton's Library, which is the third chapter as the paper now stands, is really the earliest, and gains in effect if it be read first.

But, read first or last, the reading is delightful always. One can trace Sir William's interest in Burton through many of his earlier papers and addresses. In his paper on Keats, read at the Johns Hopkins Historical Club, for the welfare of which he laboured so long and lovingly, he quotes, in a note (An Alabama Student and Other Biographical Essays. Oxford, 1926, p. 53), the last words of Burton's section on Suicide, in The Anatomy. He quotes him again in his Essay on Elisha Bartlett (*ibid.*, p. 139). In the paper, now for the first time printed as a unity in these proceedings, we have, if one may use comparatives or superlatives when all is so good, we have Sir William at his best. His English style has become an instrument fitted so compactly to his imagination that there are no rough, no strained passages, as sometimes occur in his earlier writings. Possibly it may have been pointed out a hundred times, but in reading Sir William, I am always impressed anew with the fact that the power and terseness of his English style is, in great measure, the result of his intimate knowledge with the English of the King James' Version of the Bible. At every turn, one meets with twists and echoes of language that are recognised in their true colours only by a reader who knows his English Bible as well as Sir William did. Those of us who have been fortunate enough to spend our boyhood, as he spent his, in the somewhat stiff atmosphere of a "Church School," know where he got his intimate acquaintance with Bible and sound English.

We are deeply indebted to the Oxford Bibliographical Society for putting into our hands, not only Sir William's papers on Burton, but also the most valuable material contained in the other pages of this volume of their Proceedings.

J. R. O.

L'Insuline. By ÉMILE AUBERTIN, Chef de Clinique Médicale à la Faculté de Médecine de Bordeaux. Preface by Professeur Agrégé P. Mauriac, Médecin des Hôpitaux. Octavo with 490 pages and 23 charts. Paper, 45 fr. (*Gaston Doin & Cie., Paris, 1926.*)

The author, writing at the beginning of 1926, says, in substance: "For the first three years following the discovery of insulin, new facts of the highest interest came to light daily. During the past year their number and importance have markedly diminished. The problem is evidently becoming stabilized. But while on certain points, as in the field of therapeutics, for example, the results have been brilliant, other points are still far from being cleared up. Insulin has created more new problems than it has solved. It seemed that, to aid in the solution of these problems, the time had come when the widely scattered observations which have been made in this field should be brought together, grouped and classified, undoubted facts being distinguished from those which are doubtful or even contradictory, so as to show what actually has been done and especially what still remains to be done and what general lines future investigations must follow."

The book is divided into three parts: I. Discovery, Preparation and Nature of Insulin (94 pp.); II. Physiological Properties and Mode of Action (203 pp.); III. Therapeutic Use (136 pp.). Each part is divided in turn into chapters and subheadings under which is classified the information gleaned from over 250 journals. The thoroughness with which the author has searched the literature is indicated by the fact that the bibliography for Part I contains some 250 references, for Part II about 350 and for Part III nearly 650. As in most French books, there is no index, but the material is so well classified that any desired subject can be located without much difficulty by means of the table of contents. The book should prove especially useful in supplying quickly reliable information upon the work done on any particular phase of the insulin question.

C. A. R.

Brain and Heart. Lectures on Physiology. By GIULIO FANO. Translated by. Helen Ingleby with a foreword by E. H. Starling. ix, 142 pp. $2.75 (*Oxford Medical Publications, Oxford University Press, 1926.*)

This little volume is a collection of six lectures delivered at the Universities of Barcelona and Madrid. Its title is a misnomer, for it is far from a monograph on the organs—heart and brain. Instead, it aims to give a general outlook on the relation of physiology to philosophic thought. The first half of the book is devoted to a general discussion ranging from an evaluation of the contribution of chemistry to the problem of life to the Darwinian hypothesis. The latter half

is constructed around Fano's own researches on the brain of the tortoise and the embryonic heart of the chick. He applies the results of his studies on these organs to a discussion of the origin, life and behavior of man.

As Professor Starling points out in his foreword, Fano is not only a great Italian physiologist but a philosopher, artist and man of letters, using the broad outlook offered by the data of Physiology as a basis for his speculations. This book bears out this estimate of the man.

To illustrate its character, the chapter on *Inhibition and Will* may be taken as an example. Beginning with a discussion of the nomenclature of the tortoise, Fano is led to quote Claude Bernard on the frog's services to science. This leads him to Francesco Redi, to the martyrdom of Galileo, to a discussion of the natural philosophy of the 17th Century and the Academia del Cimento. After five pages of these interesting digressions he returns to the lowly chelonian by a quotation from the experiments of Redi on the effect of the removal of the brain on these animals.

The book will be of interest not only to the physiologist but also to the general reader.

A. G.

Diseases of the Bronchi, Lungs and Pleura. By FREDERICK T. LORD. 2nd Ed. 776 pp. $8.00. (*Lea & Febiger, Phila. and New York, 1925.*)

Although numerous treatises on physical diagnosis give adequate and even exhaustive expositions of the physical signs of diseases of the bronchi, pleura and lungs, really comprehensive presentations of the maladies of the lower respiratory tract are few. Not since the publication of Fowler and Godlee's thorough work on the subject, now unfortunately unrevised and out of print, did a book of comparable value or scope appear in English until Doctor Lord's volume, entitled "Diseases of the Bronchi, Lungs and Pleura."

The first edition of this work, admirable as it was, lacked a discussion of pulmonary tuberculosis and therefore was incomplete. The second edition, published in 1925, has been enlarged to include this important subject.

Authoritative in fact and orderly in arrangement, the topics are presented in a direct and lucid manner. Established truths are given just value in their relation to less valuated theories or data without unnecessary elaboration, yet with sufficient breadth of discussion. The illustrations are good and there is a satisfactory index. The book is entitled to a place among the foremost of those of its scope.

C. R. A.

Comparative Anatomy of Vertebrates. By J. S. KINGSLEY. 470 pp. $4.00. (*P. Blakiston's Son Co., Phila., 1926.*)

This book has long been well and favorably known to anatomists and zoologists. The first part is devoted to the presentation of the elements of embryology and histology, thus preparing the reader for a better appreciation of the more purely

anatomical facts which follow. No detailed description of the structure of the different species is attempted, but the author gives a satisfactory outline of the morphology of vertebrates, comparing anatomical facts, correlating them with each other and with the conditions found in the major groups of vertebrates. While not large, the book contains a vast amount of well selected information on the comparative structure of vertebrates. It is to be regretted, however, that the author has not deemed it advisable to attempt a more complete correlation of structure and function, for it is believed that its usefulness would thereby be greatly increased.

W. V. W.

Hydrogen-Ion Concentration of the Blood in Health and Disease. Medicine Monograph No. VIII. By J. HAROLD AUSTIN and GLENN E. CULLEN. 75 pp. $2.00. (*Williams & Wilkins Co., Baltimore, 1926.*)

This book, the eighth of this series of Monographs, well sustains the standards established by its predecessors. One must have sympathy with writers of books similar to this one, designed "to bring together the most important facts in a concise form for the use of clinicians and workers in our clinical laboratories," for it is obviously difficult to sift out of the vast mass of accumulated data the significant from the relatively less important material so that it can be compressed into a small volume. Many will probably differ as to the relative importance of details. The data collected on the "pH of Plasma in Disease" are valuable, although one could wish for a more extended statement of studies made in conditions of abnormal respiration, upon the effects which occur during and following severe exercise, after burns, in conditions producing anoxemia, and following the administration of alkalies and other drugs. We wonder if "pH" is a good enough English word to appear as a chapter title heading.

We must confess to some sense of disappointment at the meagerness of the practical results of these direct hydrogen-ion studies applicable to clinical diagnosis and therapy. The determination of the carbon dioxide capacity of the plasma as measured by the Van Slyke method nearly always gives all the information practically needed. We are not impressed with the "striking example of the value of pH studies" (mentioned on page 22) upon one of Cullen and Stillman's patients suffering from acute convulsions, whose "pH" was brought from 7.12 to 7.35 with "strenuous alkali therapy" and who recovered (*propter hoc*) from the attack. Nor do the results with insulin seem as yet sufficiently substantiated. A good list of references is appended. On the whole, the writers have done very well with the text space at their disposal—sixty-two small pages, but the abbreviation must necessarily prove a serious handicap to the value of such a presentation to those who have had no previous knowledge of the subject.

G. A. H.

Auricular Fibrillation. By J. G. EMANUEL, M.D. pp. 31. 3/6 net. (*Cornish Brothers Ltd.*, Birmingham, England, 1926.)

This little book is printed from two Ingleby Lectures, delivered at the University of Birmingham, England. The author presents a brief history of the development of our knowledge of auricular fibrillation, touching lightly upon the experimental side before giving the clinical picture which is not presented in sufficient detail. In the section devoted to etiology he stresses too strongly the effect of various "toxins" as giving rise directly to auricular fibrillation. Vomiting is given as a symptom of auricular fibrillation, "a direct reflex stimulation of the vomiting center set up by the rapid and irregular action of the heart," and several cases are cited in which this was a distressing symptom without making it clear that it was not a sign of myocardial insufficiency.

The second lecture devoted to treatment is quite attractively written and takes up the use of digitalis and quinidine sulphate. Unfortunately, the author speaks only for a proprietary form of digitalis, a powerful digitoxin.

There are fifteen full page plates of electrocardiographic records and diagrams which help make the book useful for the medical student.

L. E. M.

The Peaks of Medical History. An Outline of the Evolution of Medicine. By CHARLES L. DANA, A.M., M.D., LL.D. Illustrated with 40 full-page Plates and 16 Text Illustrations. 104 pp. $3.00. (*Paul B. Hoeber. Inc., New York, 1926.*)

The productions of medical historiographers in America must be considered always in connection with the circumstances that surround their making. In this country, The History of Medicine is scarcely ever the one exhaustive interest in the life of the man who writes about it. It is a hobby, a parergon, an interest subservient and secondary to Neurology, Internal Medicine or Psychiatry, or whatever the dominating interest of the writer's professional activity may be. And therefore, among American Medical Historians, there is—with perhaps one or two exceptions—no one who has had the training or who can command the time whereby he may prove himself an "authority" in the entire field. And even of my two "exceptions," one, at least, is never weary of insisting that he knows very little of Ancient or Mediaeval Medicine, and can claim authoritative knowledge in the field of Modern Medicine alone. The best that the rest of us can do is to select some well-defined period of medical history, and to attempt to achieve a first-hand knowledge of it, sufficient to give us some shadow of authority in dealing with it. Therefore, when one is asked to review a work that covers the entire field of medical history, one must admit, at the beginning, that one lacks an equipment adequate to the task. All that one may safely and fairly attempt is an appreciation of such chapters as deal with the periods with which one is tolerably familiar.

Dr. Dana has arranged—or rather, he considers—the great stream of medical history as an ocean-river—a river that ebbs and flows and has waves, the level

of which, at various times, rises to a high crest or peak. At the summit of each peak, he places some great personality, Hippocrates on the Grecian peak, Harvey on the sixteenth century peak, and so on. One may, I think, question the 'Peak' Idea, from the standpoint of contemporary vision. In Greece, for instance, if there had been a Gold-Headed Cane anywhere about, it would probably not have gone to the rather uncouth itinerant medical teacher from Cos, who spent so much of his time in Thrace that he wrote a sort of Thracianized Greek, but rather to the polished, witty friend of Plato's, Dr. Eryximachus, who doubtless had a perfect bed-side manner. However, the 'Peak Arrangement' is helpful to the modern student, no matter what stumbling-blocks it may put in the way of the medical historian.

Dr. Dana's Chapter II, on the Hippocratic Period, puts a slight strain on our credulity. The statements (pp. 21–22) that Hippocrates "drove the plague from Athens, relieved Democritus of insanity and cured the king of Macedonia of a wasting passion for his mother-in-law" are in no sense historical, their only source being the apochryphal appendix to the Hippocratic Corpus and the Life by Soranus who flourished under Trajan. To give them as actual events in the life of Hippocrates is like writing a Life of Christ on the basis of the Apochryphal Gospels.

Again (on p. 20), Dr. Dana seems to believe that Hippocrates wrote his works by collecting the descriptions of their ailments, written by patients on the "ex voto's," hung up in the temples of Asclepius. A most peculiar idea. The only medical inscriptions that describe cures are those found at Epidaurus (Cf. Dittenberger's Sylloge, vol. III, nos. 1168–1173) and no modern scholar has ever discovered any parallels between them and the earliest books of the Corpus Hippocraticum.

Dr. Dana does not even mention the Corpus, which was, for over two thousand years, The Bible of Medicine. He omits all mention of Aretaeus, one of the really great minds of Grecian medicine. His statements about Celsus would have to be entirely revised in the light of the lately published researches of Prof. Wellman (Sudhoff's Arch., 1926).

The illustrations, however, are interesting. But the descriptive titles below them are sometimes misleading or inadequate. The printer or proof-reader is probably more to blame than Dr. Dana. Inadequate, for example, is the description of the statue of Aesculapius, the Frontispiece, as the student might naturally want to know where it is to be seen. In Rome, and, I think, in the Capitoline Museum. Also the plate facing p. 54, described as "Pictures of Operations performed at Salerno in the thirteenth century (British Museum)." The student should be told that it is taken from a 13th century manuscript of a *French* translation of the Surgical Treatise of Roger Frugardi. Inaccurate seems the title "A Charlatan's Office, Germany, 1744" (to face p. 78), for the old man on the right is evidently doing a formal Uroscopy, while the names on the bottles and boxes on his shelves, (e.g. Pilulae Obstruct. fürs Unterleib) show that he is probably an Apothecary of the better sort. More misleading still is the description

of Plate facing p. 55, described as "Title Page of Vesling's Anatomy, showing method of *operating* in seventeenth century," for the title-page, here re-produced, represents, not an operation, but a typical Anatomical Demonstration in a Theatrum Anatomicum. Surely, Dr. Dana, who writes so interestingly of Vesalius, has not forgotten the famous title-page of the "De Fabrica."

The Bibliographical Notes, at the end of the book, contain useful material, especially the section on American Medicine (pp 99–100), in which one finds the titles of some "gossipy, anecdotal, biographical books," hard to find, often almost unknown, yet very stimulating. Some rather important titles might be added to the other sections, which omit the medical histories of Heiser and Pagel-Neuburger, and which cite but do not give the title of the Meyer-Steineg-Südhoff *Geschichte der Medizin in Ueberblick*. The least complete section on Hippocrates omits all mention of the Corpus Medicorum Graecorum, in process of publication by the Prussian Royal Academy, of the only authoritative study of "Temple Sleep," and suggests that Francis Adams and Dr. W. H. S. Jones have "translated Hippocrates," whereas Adams translated only a portion of the whole Corpus and Jones a smaller portion still. Littré's ten volumes are not "on Hippocrates;" they are Hippocrates, or as much of him as we possess today. To the section on Galen, one might add (p. 97) that his *De Usu Partium* has been translated into English, as one of the volumes of the Loeb Classical Library. Finally, general notes on medical bibliography should not fail to mention the Monumenta Medica, published by the famous House of Lier in Florence.

All these things, however, are details. The really important outstanding thing in connection with this book is the fact that a very distinguished and very busy American physician has taken so deep an interest in the History of Medicine that he has been willing to sacrifice time and energy in order to write a book about it. And where there is one man, anxious and able to write the book, perhaps, in time, there will be a hundred anxious and willing to read it. There ought to be a thousand.

Still, it is well to remember that no one, no matter what his mental abilities may be, can write sanely and surely about any period in the History of Medicine, unless he is able to read, in the original language, the contemporary documents on which the history of that period chiefly rests.

J. R. O.

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